LAKE WAVELAND

Montgomery and Parke Counties

2005 Fish Management Report

Christopher C. Long

Assistant Fisheries Biologist

INDIANA DIVISION OF

FISH&WILDLIFE

Fisheries Section
Indiana Department of Natural Resources
Division of Fish and Wildlife
I.G.C.-South, Room W273
402 W. Washington Street
Indianapolis, Indiana 46204

2007

EXECUTIVE SUMMARY

- Lake Waveland is a 358-acre impoundment located approximately 2 mi west of Waveland, Indiana.

- A total of 2,153 fish (largemouth bass, bluegill, and gizzard shad) that weighed approximately 514 lbs was collected in the survey.

- Bluegill was the most abundant species collected with 1,350 individuals. Bluegill ranged in length from 1.1 to 9.0 in and averaged 4.1 in. Bluegill growth was average at age 1 and above average at ages 2 and 3 compared to other lakes in central Indiana. Approximately 65% of bluegill were age 2.

- Altogether, 507 largemouth bass were collected. Largemouth bass ranged in length from 0.8 to 17.5 in and averaged 9.7 in. Ages 1 through 3 largemouth bass were well represented.

- A total of 296 gizzard shad was collected at a CPUE of 98.7/h. Gizzard shad ranged in length from 1.5 to 15.8 in and averaged 9.3 in. Several year classes were present indicating that the population has expanded since 2003.

- A selective eradication of gizzard shad was conducted on September 14, 2005. A mortality assessment was conducted on September 15, 2005. Seventy-six percent of the fish observed were gizzard shad, 23% were bluegill, and approximately 1% were largemouth bass.

- Muskellunge stockings began in 2004. A total of 10 muskie were collected during the spring and fall sampling. Annual muskie stockings should continue at a rate of five muskie per acre (1,790 total). A stocking evaluation will be conducted in 2006.

- The fishery should be resurveyed in 2006 to evaluate the effectiveness of the gizzard shad management strategies. The survey will focus on the age, growth, and abundance of largemouth bass, bluegill and gizzard shad.

INTRODUCTION

Lake Waveland is a 358-acre impoundment located approximately 2 mi west of Waveland, Indiana. The Waveland Park Board manages much of the property surrounding the lake. Little Raccoon Creek Conservancy District owns the lake, but the fishery is managed by the Indiana Department of Natural Resources, Division of Fish and Wildlife (DFW). A boat ramp and several shoreline fishing areas are available for anglers to access the lake.

Historically, Lake Waveland was known for its quality panfishing opportunities. However, in 1994 gizzard shad were discovered in the lake (Dorsett 1995) and the population exploded by 1998. As a result of the expanded shad population, largemouth bass and bluegill recruitment declined. In 1998, a complete renovation of the lake was recommended (Wisener 1999).

In 2002, a total renovation was conducted to eliminate gizzard shad and common carp. To ensure its success, fish populations in the streams feeding the lake and three ponds were also eradicated. The lake was restocked in the fall of 2002 and spring of 2003 with bluegill, largemouth bass, redear sunfish, and channel catfish (Table 1). A fisheries survey was conducted in 2003 to determine the success of the renovation and restocking. Largemouth bass were abundant and reproduction and recruitment were apparent. Bluegill were poorly represented and no redear sunfish were collected. Therefore, to boost the sunfish populations, additional bluegill and redear fingerlings were stocked in the fall of 2003. Black crappie were also stocked in the fall of 2003.

Unfortunately, gizzard shad were collected in 2003 and made up approximately 26% of the fishery even after the lake was completely renovated in 2002. If the gizzard shad population was left unchecked, the expected benefits of conducting the renovation would likely be short lived. Several management strategies were recommended and implemented at Lake Waveland as part of a larger project being conducted by the DFW to explore options for managing gizzard shad and reducing their impacts on sportfish populations. These included conducting a selective eradication of gizzard shad, annual winter drawdowns, and annual stockings of muskellunge (Keller 2004).

Muskellunge stockings began in 2004 at a rate of five per acre (1,790 total). Muskie stockings alone will not provide adequate control of the gizzard shad population. But once established, adult muskie will be able to effectively forage on large gizzard shad that would otherwise not be utilized. Muskie will also provide an additional sportfish for anglers to target.

In 2005, a largemouth bass, bluegill, and gizzard shad survey, a selective eradication of gizzard shad, a pre and post-selective gizzard shad survey, a submersed aquatic vegetation survey, and a spring and fall muskie evaluation were conducted.

Fisheries Survey: Largemouth bass, Bluegill, and Gizzard shad

One hour of pulsed DC night electrofishing was conducted weekly from June 7 to 20, 2005 with two dippers. Total sampling effort was 3.0 h (twelve, 15-min stations). Only largemouth bass, bluegill, and gizzard shad were collected. All fish were measured to the nearest 0.1 in TL and scales were taken for age and growth analysis. Average weights for Fish Management District 5 were used to estimate the weight of all fish collected. Proportional stock density (PSD) was calculated for largemouth bass and bluegill (Anderson and Neumann 1996). The goals of the 2005 fisheries survey were to evaluate the age, growth, and abundance of largemouth bass, bluegill, and gizzard shad and determine if a selective eradication of gizzard shad would be necessary in 2005.

A total of 2,153 fish that weighed approximately 514 lbs was collected. With 1,350 individuals in the sample, bluegill was the most abundant species collected. The catch rate (CPUE) of bluegill was 450.0/h and relative abundance was 63%. This was much improved from 1998 (before the lake was renovated) when CPUE was 170.0 bluegill/h and relative abundance was 41% (Figures 1 and 2). Bluegill ranged in length from 1.1 to 9.0 in and averaged 4.1 in. Bluegill PSD was 11. Only 11% of the bluegill collected were considered harvestable (6 in or larger). Bluegill growth was average at age 1 and above average at ages 2 and 3. Approximately 65% of bluegill were age 2.

Altogether, 507 largemouth bass were collected. CPUE was 169.0 bass/h and relative abundance was 24% compared to 1998 when CPUE was 35.3 bass/h and relative abundance was a mere 8% (Figures 1 and 2). Largemouth bass ranged in length from 0.8 to 17.5 in and averaged 9.7 in. Largemouth bass PSD was 54. Ages 1 through 3 largemouth bass were well represented. Growth was slightly above average at age 1 and well above average at ages 2 and 3.

A total of 296 gizzard shad was collected resulting in a CPUE of 98.7 shad/h. Relative abundance of gizzard shad was 14%. Gizzard shad ranged in length from 1.5 to 15.8 in and averaged 9.3 in. While scales were not useful in aging the gizzard shad, the length-frequency indicated at least three year classes were present (YOY, 1, and 2).

While the 2005 fisheries survey confirmed that sportfish populations were exhibiting good growth and recruitment, it also verified that the gizzard shad population had expanded since 2003. If the expanding gizzard shad population was left unchecked, growth and recruitment of largemouth bass and bluegill would suffer over time, and the lake would likely return to its pre-renovation state (poor fishing due to overabundant shad). Therefore, to maintain a quality sport fishery, a selective eradication of gizzard shad was conducted in September 2005.

Gizzard shad Selective

On September 6, 2005 the drain was opened and within a week the lake was drawn down approximately 2 ft. The lake was drawn down in order to concentrate the fish, reduce the likelihood of rotenone escaping from the lake, and to reduce the amount of rotenone needed.

A selective eradication of gizzard shad was conducted on September 14, 2005. The lake was divided into five treatment sections. Volume and average depth had been calculated for each section to determine the amount of rotenone required to attain the maximum allowable concentration (0.13 ppm) for a selective eradication of gizzard shad. Four crews applied rotenone from boats via boat bailers. Rotenone was applied in increments across each section. The gradual increase in concentration of rotenone helped reduce mortality of non-target species. Treatments were stopped in a section once large numbers of shad quit responding to an increased amount of rotenone and larger shad had shown evidence of being affected. Additionally, treatments were terminated in a section if many non-target species began showing adverse affects.

Small shad (YOY) began to respond almost immediately to the application of rotenone. As the concentration increased, more gizzard shad began to appear. Overall, 72 gallons of rotenone were applied. The concentrations within the different treatment sections ranged from approximately 0.075 to 0.10 ppm.

A mortality assessment was conducted on September 15, 2005. Six open-water transect counts and seven shoreline counts of dead fish were used to assess the impact of the selective. All fish were counted and identified along each transect or along the shoreline until at least 100 gizzard shad were observed. Gizzard shad represented 76% of the total fish seen during the assessment (Table 2). Twenty-three percent of the fish observed during the mortality assessment were bluegill and most were less than 3 in long. Largemouth bass accounted for only 1% of the fish observed. Very few crappie, channel catfish, and muskie were observed while conducting the mortality assessment.

Pre and Post-selective Gizzard Shad Sampling

Pre-selective sampling for gizzard shad was conducted on September 6, 2005. Post-selective sampling was conducted on October 12, 2005. One hour of pulsed DC night electrofishing with two dippers was conducted on each sampling date (four, 15-min stations). The same stations were sampled on both dates. All fish collected were measured to the nearest 0.1 in TL.

Pre-selective sampling for gizzard shad resulted in a CPUE of 126 shad/h. Gizzard shad ranged in length from 3.4 to 16.3 in and averaged 11.0 in. Ninety-eight percent of the shad collected were greater than 8.0 in long.

Post-selective sampling was conducted to determine the effectiveness of the selective eradication at reducing the shad population. No gizzard shad were collected or observed during post-selective sampling, indicating that the selective was successful at drastically reducing the gizzard shad population.

Submersed Aquatic Vegetation Survey

Submersed aquatic vegetation was sampled on August 11, 2005, using guidelines written by Pearson (2004). Overall, ten species of submersed aquatic vegetation were collected. Coontail, southern naiad, American pondweed, leafy pondweed, and Eurasian watermilfoil were the most prevalent. The maximum depth of submersed vegetation growth was 8.0 ft. The mean rake score for all sampling locations was 2.07 and the maximum number of species found per site was six. Non-submersed vegetation observed included, filamentous algae, cattail, and water willow. This data will be useful in monitoring how submersed aquatic vegetation communities may change in terms of abundance and diversity with an increase or decrease in gizzard shad abundance.

Muskellunge Evaluation

Spring and fall pulsed DC night electrofishing was conducted for 2.0 h on both April 19 and November 30, 2005 with two dippers (4.0 h total). The same eight, 15-min stations were sampled on both dates. All fish collected were measured to the nearest 0.1 in TL. During the spring survey, fish were also weighed to the nearest 0.01 lb.

Five muskie were collected during spring sampling and five were collected during fall sampling. CPUE for both spring and fall sampling was 2.5 muskie/h. Muskie collected during the spring ranged in length from 10.0 to 12.2 in and were from the first stocking in the fall of 2004. The five muskie collected during the fall sampling ranged in length from 9.6 to 10.7 in and were fish stocked a couple of weeks before the survey. Additionally, no gizzard shad were observed during the fall muskie sampling.

DISCUSSION

The selective eradication appeared to be very successful at reducing the gizzard shad population. It is likely that some gizzard shad still remain in the lake even though no shad were collected or observed during the post-selective and muskie sampling. The gizzard shad that survived the selective are still capable of producing numerous offspring, causing the population to rebound quickly. Therefore, further selective eradications will be necessary to control their abundance in order to sustain a quality sport fishery. The next selective will likely be conducted in two to three years as the gizzard shad population approaches pre-selective abundance. Annual fisheries surveys of gizzard shad, bluegill, and largemouth bass will continue to determine how the fishery is responding to the current management strategies and when the next selective should be conducted.

The selective eradication of gizzard shad created a void in the total lake biomass. Therefore, in the fall of 2005, 17,900 largemouth bass fingerlings (4.68 in) were stocked. The stocked largemouth bass will be able to take advantage of the food resources once consumed by gizzard shad and help retain a dense predator base. The goal behind the largemouth bass stocking is to reduce the amount of food and space available for YOY gizzard shad spawned in 2006. This (lack of food resources/dense predator base) will hopefully make it more difficult for YOY shad to survive.

Winter drawdowns are another management tool being implemented to manage the gizzard shad population. Natural shad die-offs are common during the winter. The lake volume will be reduced during the winter causing shad to become more crowded and stressed, which increases the likelihood of a die-off. The lake should be drawn down annually, a minimum of 5 ft by January 1, and held at this level through February. If winter drawdowns are successful at reducing gizzard shad abundance, the time between selective eradications could be extended. Additionally, the crowded conditions created by winter drawdowns will aid in the success of predators by concentrating shad and allowing predators to forage more efficiently.

Muskie stockings began in 2004. The collection of five muskie during the spring of 2005 confirmed that they survived their first winter. The five muskie collected during the fall of 2005 were presumably stocked only a couple of weeks prior to the evaluation. Future evaluations will be conducted to evaluate the success of muskie stockings. In the meantime, it is recommended that annual muskellunge stockings continue at the rate of five per acre (1,790 total).

Since the 2002 renovation, the abundance and diversity of submersed vegetation has increased substantially. The cause of this shift in vegetation abundance and diversity is likely due to the reduction of gizzard shad. Gizzard shad feed on zooplankton (aquatic invertebrates/microscopic animals), which feed on phytoplankton. Phytoplankton are tiny plants that generate oxygen, give water its greenish color, and ultimately affect how much sunlight can penetrate to the bottom, promoting the growth of vegetation. When gizzard shad are abundant, they can drastically reduce zooplankton. As a result, the abundance of phytoplankton increases, water clarity lessens, and the abundance of vegetation decreases. On the other hand, when gizzard shad are absent (or less abundant) the abundance of zooplankton increases, phytoplankton decreases, and the abundance of vegetation increases.

Anglers should have success targeting bluegill and largemouth bass, as the number of harvestable size fish should increase over the next year. In the meantime, anglers are encouraged to release largemouth bass over 14 in to help retain a high predator base and help sustain recruitment of younger year classes.

RECOMMENDATIONS

- The fishery should be resurveyed in 2006 to evaluate the effectiveness of the gizzard shad management strategies. The survey will focus on the age, growth, recruitment, and abundance of largemouth bass, bluegill, and gizzard shad.

- The DFW should continue to annually stock muskellunge at the rate of 5 per acre (1,790 total).

LITERATURE CITED

Anderson, R.O. and R.M. Neumann. 1996. Length, weight, and associated structural indices. Pages 447-481 *in* B.R. Murphy and D.W. Willis, editors. Fisheries Techniques 2nd edition. American Fisheries Society, Bethesda, Maryland.

Dorsett, M.J. 1995. Waveland Lake, 1994 Fish management report. Indiana Department of Natural Resources, Division of Fish and Wildlife. Indianapolis, Indiana. 20pp.

Keller, D.C. 2004. Lake Waveland, 2003 Fish management report. Indiana Department of Natural Resources, Division of Fish and Wildlife. Indianapolis, Indiana. 10pp.

Pearson, J. 2004. A proposed sampling method to assess occurrence, abundance and distribution of submersed aquatic plants in Indiana lakes. Indiana Department of Natural Resources. Indianapolis, Indiana. 37 pp.

Wisener, J.R. 1999. Waveland Lake, 1998 Fish management report. Indiana Department of Natural Resources, Division of Fish and Wildlife. Indianapolis, Indiana. 20pp.

Submitted by: Christopher C. Long, Assistant Fisheries Biologist
Date: September 5, 2006

Approved by: J. Rhett Wisener, Fisheries Biologist

Approved by: ____
Brian M. Schoenung, Fisheries Supervisor
Date: January 23, 2007

Table 1. Species, number, average length, and season fish were stocked at Lake Waveland after the 2002 renovation.

Species	Number	Average length (in)	Date
Bluegill	471,415	0.84	Fall 2002
	188,539	0.97	Fall 2003
Redear sunfish	131,920	0.98	Fall 2002
	90,316	1.00	Fall 2003
Largemouth bass	46,817	4.34	Fall 2002
	278	7.50	Spring 2003
	411	14.50	Spring 2003
Channel catfish	7,199	8.90	Fall 2002
	28,000	2.70	Spring 2003
	151	22.50	Spring 2003
Black crappie	71,942	1.32	Fall 2003

Table 2. Mortality assessment following the selective eradication of gizzard shad at Lake Waveland; September 15, 2005.

	Gizzard shad		Largemouth bass		Bluegill		
Station	No.	%	No.	%	No.	%	Total
Shoreline (7 counts)	803	63	24	2	457	36	1,284
Open water (6 transects)	1,583	85	14	1	276	15	1,873
Total	2,386	76	38	1	733	23	3,157

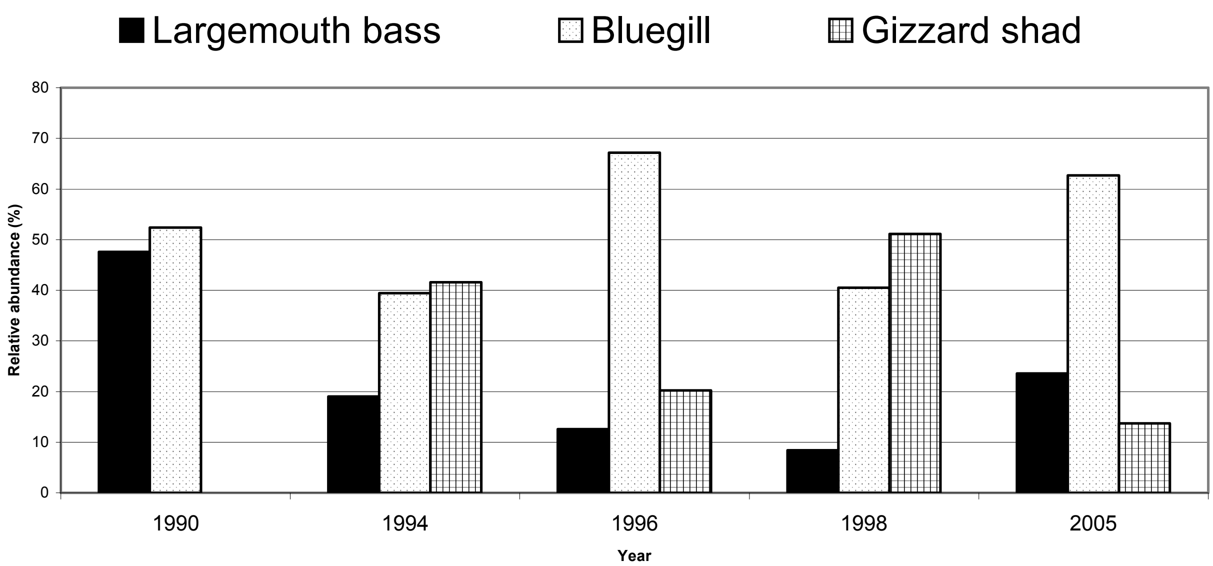

Figure 1. Relative abundance (%) of largemouth bass, bluegill, and gizzard shad collected by electrofishing at Lake Waveland from 1990 to 2005.

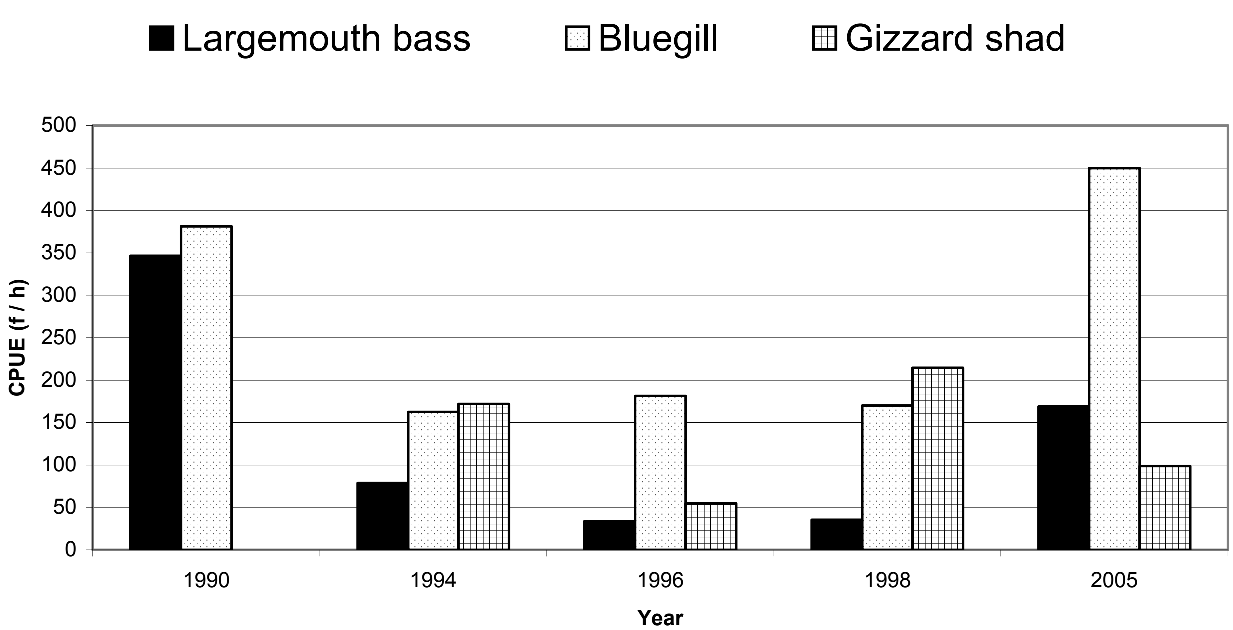

Figure 2. Electrofishing catch rate (CPUE) of largemouth bass, bluegill, and gizzard shad at Lake Waveland from 1990 to 2005.